

Claims

I claim:

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1. An apparatus for selecting a menu option from a plurality of menu options, said apparatus comprising:
- (a) a display area;
 - (b) means for at least partially delimiting a plurality of selectable regions, each of the selectable regions outside the display area and each associated respectively with a menu option;
 - 10 (c) movement related signal receiving means for receiving a movement related signal indicating successive locations with respect to the display area; and
 - (d) selection means, responsive to a first dwell event associated with any one of the selectable regions outside the display area, for selecting the menu option associated with the selectable region outside the display area associated with the first dwell event.

where
original
How associated
15 2. with movement

The apparatus of claim 1 further comprising a pointer, responsive to the movement of a body member of an operator other than either of the operator's eyes, for generating the movement related signal.

- 20 3. The apparatus of claim 1 wherein the selection means is responsive to a plurality of periods of intersection, each of two or more of the successive locations and the intersected selectable regions.
4. The apparatus of claim 1 wherein at least one of the selectable regions is not completely visible.
- 25 5. The apparatus of claim 1 wherein at most one of the selectable regions is adjacent the display area.
6. The apparatus of claim 1 wherein each of the successive locations is relative to a predetermined location on the display area or to a previous location of the successive locations.
- 30 7. The apparatus of claim 1 wherein the first dwell event includes a first quantity equalling or exceeding a predetermined quantity, the first quantity being a function of the durations of one or

more successive periods of intersection of two or more of the successive locations and one of the selectable regions; and wherein the selectable region associated with the first dwell event is the intersected selectable region.

5 8. The apparatus of claim 1 wherein the first dwell event includes a first quantity equalling or exceeding a predetermined quantity, the first quantity being a function of:

(1) the durations of one or more successive periods of intersection of two or more of the successive locations and a first one of the selectable regions; and

10 (2) the durations of one or more successive periods of intersection of two or more of the successive locations and a second one of the selectable regions; and

wherein the selectable region associated with the first dwell event is the selectable region intersected by one of the successive locations when the first dwell event occurs.

15 9. The apparatus of claim 1 further comprising a plurality of selectable regions on the display area, each associated respectively with one of the selectable regions outside the display area; and wherein the selection means is further operative, responsive to a second dwell event associated with any one of the selectable regions on the display area, to select the menu option associated with the selectable region outside the display area associated with the selectable region on the display area associated with the second dwell event.

20 10. The apparatus of claim 9 wherein the selection means is further operative, responsive to a first quantity equalling or exceeding a predetermined quantity, the first quantity being a function of:

(a) the durations of one or more successive periods of intersection of two or more of the successive locations and one of the selectable regions on the display area; and

25 (b) the durations of one or more successive periods of intersection of two or more of the successive locations and the selectable region outside the display area associated with the intersected selectable region on the display area;

to select the menu option associated with the selectable region outside the display area.

30 11. The apparatus of claim 9 wherein each of one or more of the selectable regions on the display area is adjacent the associated selectable region outside the display area.

12. The apparatus of claim 9 wherein each of one or more of the selectable regions on the display

area indicates the location of the associated selectable region outside the display area.

5 13. The apparatus of claim 9 wherein the plurality of selectable regions on the display area together at least partially circumscribe a region on the display area.

14. The apparatus of claim 13 wherein the selection means further includes means for indicating the remaining dwell time required to select the intersected selectable region.

10 15. The apparatus of claim 13 wherein the movement related signal is responsive to the movement of a body member of an operator having impaired ability to sense the position of the body member and the apparatus further comprises tactile indication means for indicating tactilely to the operator the position of the body member.

15 16. The apparatus of claim 13 wherein the selection means further includes means for indicating on the display area the location of one of the successive locations located outside the display area.

20 17. The apparatus of claim 13 wherein the selection means further includes means for indicating on the display area the distance between one of the successive locations located outside the display area and the point on the display closest thereto.

25 18. The apparatus of claim 13 further comprising an operator fatigue detector and wherein the selection means is further responsive to detected operator fatigue for varying a selection threshold period.

19. In a human interface system including a display whereon a first cursor may be displayed and moved responsive to successive locations indicated by a movement related signal, an apparatus for selecting a menu option associated with an overshoot selectable region on the display, said apparatus comprising:

30 (a) means for displaying a plurality of selectable regions within a first polygon intersecting the display, each selectable region associated respectively with a menu option, each selectable region adjacent a side of the first polygon and the plurality of selectable regions together at least partially circumscribing a region on the display;

(b) movement related signal receiving means for receiving the movement related signal indicating the successive locations; and

(c) control means for

(1) moving the first cursor within the first polygon responsive to the successive locations indicated by the movement related signal;

(2) confining at least part of the first cursor to the first polygon; and

(3) in response to a first quantity equalling or exceeding a predetermined quantity, the first quantity being a function of the durations of one or more successive periods of intersection of the first cursor and one of the selectable regions, selecting the menu option associated with the intersected selectable region.

20. The apparatus of claim 19 wherein the first polygon is located on the display.

21. The apparatus of claim 20 wherein at least one of the selectable regions intersects the at least partially circumscribed region.

22. The apparatus of claim 20 wherein the control means is further operative to confine at least part of the first cursor to a second polygon on the display.

23. The apparatus of claim 22 wherein the control means is further operative to switch, responsive to an intersection of the first cursor and one of the selectable regions, from confining at least part of the first cursor to the first polygon to confining at least part of the first cursor to the second polygon.

Sub I-125 > 24. The apparatus of claim 22 wherein the control means is further operative to switch, responsive to a distance between two of the successive locations, from confining at least part of the first cursor to the first polygon to confining at least part of the first cursor to the second polygon

25. The apparatus of claim 22 wherein the control means is further operative to switch, responsive to an angle indicated by three of the successive locations, from confining at least part of the first cursor to the first polygon to confining at least part of the first cursor to the second polygon

26. The apparatus of claim 22 wherein the first polygon intersects the second polygon.

27. The apparatus of claim 26 wherein the first polygon includes all of the area of the second polygon.

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28. The apparatus of claim 20 wherein the selection of the control means is further responsive to the proximity of one of the successive locations indicated by the movement related signal to the location of the first cursor.

10 29. The apparatus of claim 20 wherein the selection of the control means is further responsive to the proximity of one of the successive locations indicated by the movement related signal to the intersected selectable region.

30. The apparatus of claim 20 wherein the first polygon has at least five sides.

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31. The apparatus of claim 20 wherein at least one of the plurality of selectable regions is associated with an icon on the display.

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32. The apparatus of claim 31 wherein the icon represents one of a sign of a manual sign language, a location relative to a human body, a movement of a manual sign language a topic of conversation, a sentence, a desired direction of movement of a second cursor on the display, a sequence of one or more graphics including an ideograph, and a symbol of a symbol set.

25 33. An apparatus for selecting a submenu option from a menu hierarchy, said apparatus comprising:
(a) a display area;
(b) a menu comprising a plurality of menu options, at least one of the menu options associated with a submenu comprising a plurality of submenu options;
(c) means for at least partially delimiting:
30 (1) a plurality of first selectable regions, each of the first selectable regions associated respectively with one of the menu options and each of the first selectable regions including a first subregion adjacent the display area and a first subregion on the display area, the plurality of the first subregions on the display area together at least partially circumscribing a first region on the display area; and

(2) a plurality of second selectable regions, each of the second selectable regions associated respectively with one of the submenu options and each of the second selectable regions including a second subregion adjacent the display area and a second subregion on the display area, the plurality of the second subregions on the display area together at least partially circumscribing a second region on the display area;

(d) movement related signal receiving means for receiving a movement related signal indicating successive locations with respect to the display area; and

(e) selection means for selecting, in response to a first dwell event, the menu option associated with the first selectable region intersected by one of the successive locations indicated by the movement related signal, the menu option being one of the menu options associated with a submenu, and for selecting, in response to a second dwell event, the submenu option associated with the second selectable region intersected by one of the successive locations indicated by the movement related signal.

34. The apparatus of claim 33 wherein one of the menu options represents a group of characters and wherein a first one of the submenu options represents a first one character of the group of characters.

35. The apparatus of claim 34 wherein each character of the group of characters has one of:

- (a) an extension at least a predetermined distance above the baseline of the group of characters;
- (b) an extension below the baseline of the group of characters;
- (c) lack of the characteristic described in (a); and
- (d) lack of the characteristic described in (b).

36. The apparatus of claim 34 wherein the distance on the display area between the first subregion on the display area associated with the menu option representing the group of characters and the second subregion on the display area associated with the submenu option representing the first one character of the group of characters is responsive to the frequency of use of the first one character.

37. The apparatus of claim 34 wherein:

- (a) a second one of the submenu options represents a second one character of the group of characters;
- (b) the first one character is more frequently used than the second one character; and
- (c) the distance on the display area between the first subregion on the display area associated with the menu option representing the group of characters and the second subregion associated with the submenu option representing the first one character of the group of characters is less than the distance on the display area between the first subregion on the display area associated with the menu option representing the group of characters and the second subregion on the display area associated with the submenu option representing the second one character of the group of characters.

38. The apparatus of claim 34 wherein the position of a character of the group of characters indicates the position of the second subregion on the display area associated with the submenu option representing the first one character of the group of characters.

39. An apparatus for selecting a menu option from a plurality of menu options, said apparatus comprising:

- (a) a display area;
- (b) means for at least partially delimiting a plurality of selectable regions, each of the selectable regions outside the display area and each associated respectively with a menu option;
- (c) movement related signal receiving means for receiving a movement related signal indicating a location with respect to the display area; and
- (d) selection means for selecting, in response to a selection event associated with the selectable region intersected by the location, the menu option associated with the intersected selectable region.

40. The apparatus of claim 39 wherein the selection event includes a switch operation at or near the time the intersection occurs.

41. The apparatus of claim 39 further comprising means for indicating the menu option associated with each selectable region.

42. The apparatus of claim 39 further comprising means for indicating which one of the selectable regions is intersected by the location

5 43. The apparatus of claim 39 further comprising location indication means for indicating the location of each selectable region.

10 44. The apparatus of claim 43 wherein the location indication means further comprises means for displaying each menu option on the display area, wherein the location of each displayed menu option indicates the location of the associated selectable region.

45 The apparatus of claim 43 where the location indication means includes means for displaying at least part of each selectable region on the display area.

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46. The apparatus of claim 39 wherein the selection event includes a switch operation; and wherein the selection means further comprises switch operation receiving means for receiving a signal indicating the switch operation.

20 47. The apparatus of claim 39 wherein the selection means is at least partially disabled in response to a first selection event.

48. The apparatus of claim 47 wherein the selection means, in response to a second selection event, is restored to the functionality it had prior to the first selection event.

25 49. The apparatus of claim 39 wherein all or all but one of the selectable regions are partially delimited.

50. The apparatus of claim 49 wherein one of the selectable regions is completely delimited.

30 51. The apparatus of claim 49 further comprising a computer system including display means for displaying at least part of the output of an application program executable on the computer system in the region on the display area and wherein at least one of the menu options represents an input to the application program.

52. An apparatus for selecting a menu option from a plurality of menu options, said apparatus comprising:

- (a) a surface;
- (b) means for delimiting a plurality of selectable regions on the surface, each of the selectable regions associated respectively with a menu option, the plurality of selectable regions together at least partially circumscribing a region on the surface;
- (c) a pointer, responsive to the movement of a one of an operator's limbs, digits and head, for indicating successive locations on the surface; and
- (d) selection means for selecting, in response to a dwell event, the menu option associated with the selectable region intersected by one of the successive locations indicated by the pointer.

Sub I-46 18 53. An apparatus for selecting a menu option from a plurality of menu options, said apparatus comprising:

- (a) means for displaying a plurality of selectable regions on a display area, each of the selectable regions associated respectively with a menu option, the plurality of selectable regions together at least partially circumscribing a region on the display area;
- (b) movement related signal receiving means for receiving a movement related signal indicating successive locations on the surface; and
- (c) in response a quantity equalling or exceeding a predetermined quantity, the quantity being a function of the durations of a plurality of successive periods of intersection of two or more of the successive locations and one of the selectable regions, selection means for selecting the menu option associated with the intersected selectable region.

54. An apparatus for selecting an option from a menu, said apparatus comprising:

- (a) cursor movement means for receiving a movement related signal and for moving a cursor on a display responsive to the received movement signal;
- (b) delimit means for delimiting on the display a first plurality of regions and a second plurality of selectable regions, each of the second plurality of selectable regions associated respectively with a menu option; the first plurality of regions together at least partially circumscribing a first region on the display; and
- (c) selection means, responsive only to an intersection of the cursor and a first one of the first

plurality of regions and thereafter to a first selection event associated with one of the second plurality of selectable regions, for selecting the menu option associated with the selectable region associated with the first selection event.

- 5 55. The apparatus of claim 54 further comprising means for receiving a switch operation signal; and wherein the delimit means includes means for displaying the first plurality of regions responsive to the received switch operation signal.
- 10 56. The apparatus of claim 54 wherein the second plurality of selectable regions together at least partially circumscribing the first region on the display.
- 15 57. The apparatus of claim 54 further comprising a third plurality of selectable regions, each of the third plurality of selectable regions associated respectively with a menu option; and wherein the selection means is further responsive to an intersection of the cursor and a second one of the first plurality of regions and thereafter to a second selection event associated with one of the third plurality of selectable regions, for selecting the menu option associated with the selectable region associated with the second selection event.
- 20 58. The apparatus of claim 54 wherein the selection means includes means for receiving a switch operation signal; and wherein the first selection event includes:
- (1) an intersection of the cursor and the selectable region associated with the second selection event; and
 - (2) at or near the time the intersection occurs, receipt of the switch operation signal.
- 25 ~~59.~~ In a human interface system wherein a body member of an operator may indicate successive locations with respect to a display, a menu option selector for selecting a menu option from a plurality of menu options, said menu option selector comprising:
- (a) the display having thereon a first plurality of selectable regions, each of the first plurality of selectable regions associated respectively with one of the menu options;
 - 30 (b) means for at least partially delimiting a second plurality of selectable regions, each of the second plurality of selectable regions located outside the display and each associated respectively with one of the first plurality of selectable region;
 - (c) in response to a first quantity equalling or exceeding a predetermined quantity, the first

quantity being a function of:

- (1) the durations of one or more successive periods of intersection of two or more of the successive locations and one of the selectable regions on the display area; and
 - (2) the durations of one or more successive periods of intersection of two or more of the successive locations and the selectable region outside the display area associated with the one of the selectable regions on the display area;
- a selector for selecting the menu option associated with the one of the selectable regions on the display area.

60. The apparatus of claim 59 wherein the plurality of the subregions on the display together at least partially circumscribing a region on the display.

~~61.~~ In a human interface system wherein a body member of an operator may indicate a location on a surface, a menu option selector comprising:

- (a) the surface including a display area, the display area having thereon a plurality of selectable regions, each of the selectable regions associated respectively with a menu option, the plurality of selectable regions together at least partially circumscribing a region on the display area;
- (b) a clipper for generating, in response to the location indicated by the body member of the operator indicating a location outside the display area, a clipped location indicative of a location on the display area; and
- (c) a selector for selecting, in response to a selection event, the menu option associated with the selectable region intersected by the clipped location.

62. The menu option selector of claim 61 wherein each of the plurality of selectable regions is adjacent an edge of the display area.

~~63.~~ In a human interface system wherein a body member of an operator may indicate a location on a surface, a menu option selector comprising:

- (a) the surface including a display area, the display area having thereon a plurality of selectable regions, each of the selectable regions associated respectively with a menu option, the plurality of selectable regions together at least partially circumscribing a region on the display area;

- (b) a confiner for confining the location indicated by the body member of the operator to the display area; and
- (c) a selector for selecting, in response to a selection event, the menu option associated with the selectable region intersected by the location indicated by the body member of the operator.

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64. The menu option selector of claim 63 wherein each of the plurality of selectable regions is adjacent an edge of the display area.

10 Sub I-5 65. In a human interface system wherein a body member of an operator may indicate successive locations on a surface, a menu option selector comprising:

- (a) a detector area on the surface and including a plurality of selectable regions, each of the selectable regions associated respectively with a menu option;
- (b) a confiner for confining the location indicated by the body member of the operator to the detector area; and
- (c) a selector for selecting, in response to a dwell event associated with any one of the selectable regions, the menu option associated with the selectable region associated with the dwell event.

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66. The menu option selector of claim 65 wherein each of the plurality of selectable regions is adjacent an edge of the detector area.

25 Sub I-7 67. An apparatus for selecting an option from a menu, said apparatus comprising:

- (a) a display area;
- (b) means for displaying a plurality of menu options, each associated respectively with one of a plurality of switches, the display of the plurality of menu options together at least partially circumscribing a region on the display area; and
- (c) a selector for selecting, in response to a first switch operation, the menu option associated with the operated switch.

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68. The apparatus of claim 67 wherein the display means is further operative to indicate the selected menu option.

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69. The apparatus of claim 67 further comprising a plurality of submenu options associated with one of the plurality of menu options, each of the submenu options associated respectively with one of the plurality of switches; and wherein the display means is further operative, responsive to a selection of the menu option associated with the plurality of submenu options, to display the plurality of submenu options, the display of the plurality of submenu options together at least partially circumscribing the region on the display area; and wherein the selector, in response to a second switch operation, is further operative to select the submenu option associated with the operated switch.

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70. For use with a general purpose computer system including a display on which a cursor may be displayed, the general purpose computer system being capable of executing an application program, an apparatus comprising:

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- (a) a medium readable by the general purpose computer system; and
- (b) a program, stored on the medium and executable by the general purpose computer system, for:

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- (1) displaying a plurality of selectable regions within a polygon on the display, each selectable region adjacent a side of the polygon, one or more of the selectable regions each associated respectively with a sequence of one or more characters, the plurality of selectable regions together at least partially circumscribing a region on the display;
- (2) receiving a movement related signal and moving at least part of the cursor only within the polygon responsive to the movement related signal; and
- (3) in response to a first quantity equalling or exceeding a predetermined quantity, the first quantity being a function of the durations of one or more successive periods of intersection of the cursor and one of the one or more selectable regions, inputting the sequence of one or more characters associated with the intersected selectable region to the application program.

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71. A data entry system including a computer system on which may be executed an application program, said data entry comprising:

- (a) the computer system including a display;
- (b) a pointer selected from the group consisting of a (1) mouse; (2) trackball; (3) joystick; (4)

stylus and graphics tablet; (5) lightpen; (6) thumb wheel; (7) touch screen; (8) head pointer; and (9) intraoral pointer, the pointer coupled to the computer system; and

(c) program means executable on the computer system for:

- (1) displaying a plurality of selectable regions within a polygon on the display, each selectable region adjacent a side of the polygon, the plurality of selectable regions together at least partially circumscribing a region on the display;
- (2) moving a cursor within the polygon responsive to movement of the pointer; and
- (3) in response to a selection event and an intersection of the cursor and a selectable region associated with an input for the application program, inputting the input to the application program.

72. A computer access system for an operator having impaired motor capability, said computer access system including a computer system on which may be executed a computer program, said computer access system comprising:

(a) the computer system including a display;

(b) program means executable on the computer system for:

- (1) displaying a plurality of selectable regions within a polygon on the display, each selectable region adjacent a side of the polygon, the plurality of selectable regions together at least partially circumscribing a region on the display;
- (2) receiving a movement related signal and moving at least part of a cursor only within the polygon responsive to the movement related signal; and
- (3) in response to a selection event and an intersection of the cursor and a selectable region associated with an input for the computer program, inputting the input to the computer program.

Sub B1 73. A speech synthesis system comprising:

- (a) a display on which may be displayed a plurality of selectable regions within a polygon on the display, each selectable region adjacent a side of the polygon and one or more of the selectable regions associated respectively with a sequence of one or more characters, the plurality of selectable regions together at least partially circumscribing a region on the display;
- (b) a speech synthesizer; and

(c) control means for:

- (1) receiving a movement related signal and moving a cursor within the polygon responsive to the movement related signal;
- (2) repetitively, in response to a selection event and an intersection of the cursor and one of the selectable regions associated with one of the one or more sequences of one or more letters, appending the sequence associated with the intersected selectable region to at least one previously selected sequence; and
- (3) speaking, by means of the speech synthesizer, the word spelled by the appended sequences.

74. A device controller comprising:

- (a) means for displaying a plurality of selectable regions within a polygon on a surface, each selectable region adjacent a side of the polygon and each selectable region associated respectively with a device control function, the plurality of selectable regions together at least partially circumscribing a region of the polygon;
- (b) signal generating means coupled to a device for generating a device control signal; and
- (c) control means for:
 - (1) receiving a movement related signal and moving at least part of a cursor only within the polygon in response to the received movement related signal; and
 - (2) in response to a selection event, generating a device control signal corresponding to the device control function associated with the one of the plurality of selectable regions intersected by the cursor.

75. The device controller of claim 74 wherein the device includes any one of a wheelchair, a household appliance, an appliance for use in an office, a workstation, a robot, and a computer peripheral.

76. An apparatus for editing a document, said apparatus comprising:

means for selecting a first sequence of one or more graphic symbols from a plurality of sequences of one or more graphic symbols, at least part of each of the plurality of sequences having a common attribute for optical recognition purposes;

means for inputting the first sequence into the document;

means for delimiting on a display a plurality of selectable regions, the plurality of selectable regions together at least partially circumscribing a region on the display, at least two of the selectable regions associated respectively with a sequence of the plurality of sequences;

means for displaying on the display the at least two sequences of the plurality of sequences associated with the at least two selectable regions;

means for receiving a movement related signal and moving a cursor on the display responsive thereto; and

in response to a selection event wherein the cursor at or near the time the selection event occurs intersects any one of the at least two selectable regions, means for inputting the sequence associated with the intersected selectable region into the document.

77. The apparatus of claim 76 further comprising means, responsive to the selection event, for deleting the first sequence from the document.

78. For use with a surface comprising a display area, a method of selecting a menu option from a plurality of menu options, said method comprising the steps of:

at least partially delimiting a plurality of selectable regions, each of the selectable regions associated respectively with a menu option and each of the selectable regions including an invisible subregion outside the display area and a visible subregion on the display area, the plurality of visible subregions together at least partially circumscribing a region on the display area;

receiving a movement related signal indicating successive locations with respect to the display area; and

selecting, in response to a dwell event associated with one of the selectable regions, the menu option associated with the selectable region associated with the dwell event.

79. For use with a human interface system wherein a body member of an operator may indicate successive locations on a surface, the surface including a display area, the display area having thereon a plurality of selectable regions, each of the selectable regions associated respectively with a menu option and the plurality of selectable regions together at least partially circumscribing a region on the display area, a method of selecting a menu option from a plurality of menu options, said method comprising the steps of:

confining each of the successive locations to the display area; and

selecting, in response to a dwell event associated with one of the selectable regions, the menu option associated with the selectable region associated with the dwell event.

80. A method of speaking using a speech synthesis system including a display and a speech synthesizer, said method comprising the steps of:

displaying a plurality of selectable regions within a polygon on the display, each selectable region adjacent a side of the polygon and one or more of the selectable regions associated respectively with a sequence of one or more characters, the plurality of selectable regions together at least partially circumscribing a region on the display;

receiving a movement related signal and moving at least part of a cursor only within the polygon responsive to the movement related signal;

repetitively:

(i) in response to a first quantity equalling or exceeding a predetermined quantity, the first quantity being a function of the durations of one or more successive periods of intersection of the cursor and one of the one or more selectable regions, selecting the sequence associated with the intersected selectable region; and

(ii) appending the selected sequence to at least one previously selected sequence; and

speaking, by means of the speech synthesizer, the word spelled by the appended sequences.

81. A method of inputting data to a computer program for an operator having impaired motor capability, said method comprising the steps of:

displaying a plurality of selectable regions within a polygon on a display, each selectable region adjacent a side of the polygon and each selectable region associated respectively with an input for the computer program, the plurality of selectable regions together at least partially circumscribing a region on the display;

receiving a movement related signal and moving at least part of a cursor only within the polygon responsive to the movement related signal; and

in response to a first quantity equaling or exceeding a predetermined quantity, the first quantity being a function of the durations of one or more successive periods of intersection of the cursor and one of the selectable regions, inputting the input associated with the intersected selectable region to the computer program.

